HAVERHILL RETIREMENT SYSTEM

ACTUARIAL VALUATION
as of
January 1, 2020

KMS Actuaries, LLC
52 Hunt Road
Kingston, NH 03848

October, 2020

KMS

ACTUARIES

LLC

October 1, 2020

Haverhill Retirement Board
4 Summer Street
Room 303
Haverhill, MA 01830

Dear Board Members:

We are pleased to present the enclosed report providing the results of our actuarial valuation of the Haverhill Retirement System as of January 1, 2020. Our valuation was performed in accordance with the provisions contained in Chapter 32 of the Massachusetts General Laws, "M.G.L.", as of January 1, 2020. Disclosures under GASB Statement No. 67, Financial Reporting for Pension Plans (GASB 67) and GASB Statement No. 68, Accounting and Financial Reporting for Pensions (GASB 68) are provided in a separate report.

The principal results of our valuation are summarized in Section 2. The Summary of Plan Provisions and Actuarial Assumptions and Methods are shown in Sections 5 and 6, respectively. Section 7 summarizes the demographic profile of active members, retired plan members and beneficiaries and disabled plan members. Asset information and actuarial liabilities are presented in Section 2. The development of the required appropriations pursuant to Chapter 32 of the M.G.L. is shown in Section 3, including a 30-year forecast of the required appropriations and projected cash flows. Section 4 includes a summary of valuation information for PERAC as well as information relating to the primary risks to the System and an assessment of those risks.

This valuation is based upon member data provided by the Haverhill Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Retirement Board. Although we did not audit the data used in the valuation, we believe that the information is complete and reliable.

Liabilities presented in this report are based on a long-term investment return rate assumption of 7%, net of investment expense, compounded annually.

This report was completed in accordance with generally accepted actuarial standards and procedures, and conforms to the Code of Professional Conduct of the American Academy of Actuaries. The actuarial assumptions used in the determination of costs are reasonably related to the experience of the System and to reasonable expectations, and represent our best estimate of anticipated long-term experience under the System.

Future actuarial valuation results may differ significantly from the current results presented in this report. Examples of potential sources of volatility include plan experience differing from that anticipated by the economic or demographic assumptions, the effect of new entrants, changes in economic or demographic assumptions, the effect of law changes and the delayed effect of smoothing techniques.

Our valuation follows generally accepted actuarial methods and we perform such tests as we consider necessary to assure the accuracy of the results. The amounts presented in this report have been appropriately determined according to the actuarial assumptions and methods stated herein.

This report is intended for the sole use of the Haverhill Retirement Board and is intended to provide information to comply with the stated purpose of the report. It may not be appropriate for other purposes.

The undersigned credentialed actuaries are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinion contained herein. They are available to answer any questions with regard to this report.

Respectfully submitted,

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SECTION 1 - EXECUTIVE SUMMARY

Background

We have completed the Actuarial Valuation of the Haverhill Retirement System as of January 1, 2020. This valuation is based upon census data provided by the Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Haverhill Retirement Board. Information for the prior valuation completed as of January 1, 2018 was obtained from the valuation report prepared by Stone Consulting.

Massachusetts General Laws

The valuation was prepared in accordance with Chapter 32 of the Massachusetts General Laws ("M.G.L."). The results are based on the active, inactive and retired members and beneficiaries as of December 31, 2019, the assets as of December 31, 2019 and assumptions regarding investment returns, salary increases, mortality, turnover, disability and retirement.

The valuation does not take into consideration:

- Changes in the law after the valuation date,
- Transfers between retirement systems pursuant to Section 3(8)(c) of Chapter 32,
- State-mandated benefits and
- Cost-of-living increases granted to members in pay status between 1982 and 1997.

GASB Statement Numbers 67 and 68

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, Financial Reporting for Pension Plans, replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, Accounting and Financial Reporting for Pensions, replaced the requirements of Statement No. 27.

The pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

The required disclosures and notes under GASB Statement Number 67 and 68 for the fiscal year ending December 31, 2019 are provided in a separate report.

Assets

This valuation is based upon asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Haverhill Retirement Board. The market value of assets increased from $201,720,749 as of December 31, 2017 to $217,948,317 as of December 31, 2019. During the plan years ended 2018 and 2019, the market value rates of return were -1.77% and 15.51%, respectively.

The actuarial value of assets increased from $194,942,332 as of January 1, 2018 to $212,714,794 as of January 1, 2020. During the plan years ended 2018 and 2019, the rates of return on the actuarial value of assets were 4.56% and 8.24%, respectively.

Changes Since the Last Valuation

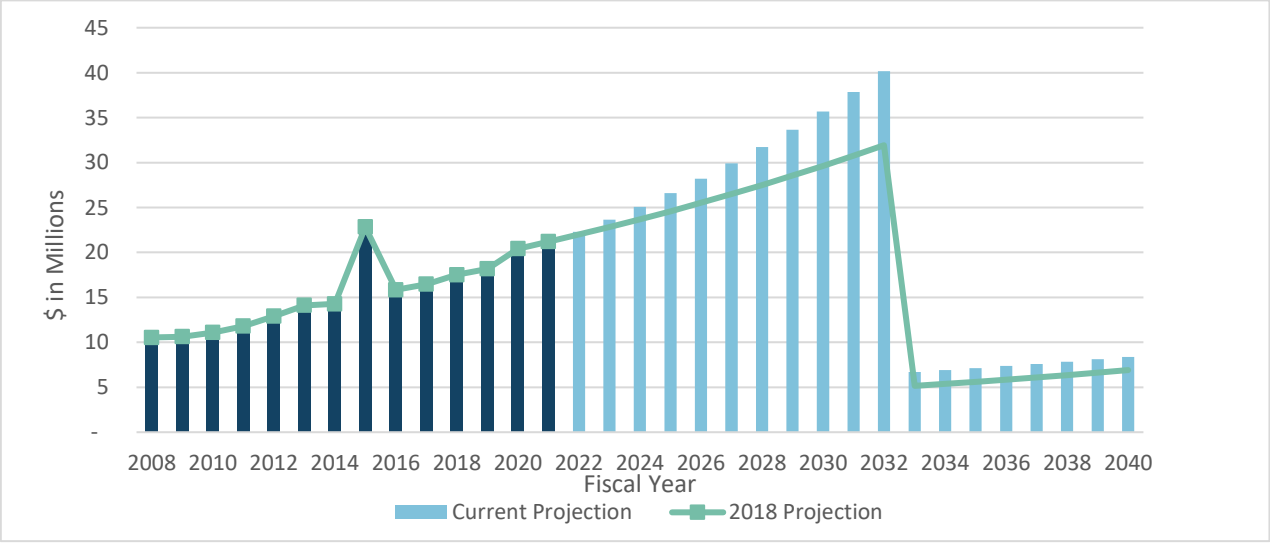
During the two years since the last valuation, the total unfunded actuarial accrued liability of the System was expected to decrease from $180,557,251 as of January 1, 2018 to $168,269,125 as of January 1, 2020, for a total decrease of $12,288,126. The actual unfunded actuarial accrued liability, before any assumption or plan changes, was $175,046,477, resulting in an actuarial loss of $6,777,352. The actuarial loss was primarily due to an asset loss of approximately $3,600,000 and a demographic experience loss of approximately $3,177,000. The details of the gain and loss analysis are provided in Section 2, Actuarial Experience.

Appropriations

The funding appropriation for each year is computed as the sum of the normal cost, net 3(8)(c) transfers and an amortization payment to pay off the Unfunded Actuarial Liability, adjusted for annual payments of the appropriation made July 1. The appropriation calculated as of the January 1, 2020 valuation is $22,973,042, and is made up of a normal cost payment of $4,188,109, net 3(8)(c) transfers of $502,703, and an amortization payment of $18,282,230. The amortization method is an increasing amortization of the unfunded actuarial accrued liability at 4% over 12 years and is expected to fully pay the unfunded actuarial accrued liability by the year 2032. The development of the appropriation as of January 1, 2020 is presented in Section 3, Annual Appropriations.

For fiscal year 2021, we show the actual appropriation developed under the previous funding schedule and reported on the PERAC "Required Fiscal Year 2021 Appropriation" letter dated November 12, 2019 of $21,190,884. For fiscal year 2022, we developed an annual appropriation of $22,292,809, which is made up of a normal cost of $4,228,606, net 3(8)(c) transfers of $520,000 and payment toward the unfunded actuarial accrued liability of $17,544,203. The unfunded actuarial accrued liability is expected to be fully paid by 2032. The Board adopted a schedule that limits the annual increase in appropriation to 5.2% in FY2022 and 6.06% thereafter. The current funding schedule is shown in Section 3, Exhibit 3.1.

The chart below shows the historical (navy bars) and projected (blue bars) annual appropriations compared to the projected amounts shown in the prior valuation and funding schedule (green line).



Plan Provisions

The COLA base was increased from $12,000 to $13,000, resulting in a net increase in the unfunded actuarial accrued liability of $2,150,157 and an increase in the employer normal cost of $33,656. All Plan provisions used in this valuation are summarized in Section 5, Summary of Plan Provisions.

Actuarial Assumptions and Methods

Some Actuarial Assumptions and Methods used in this valuation have changed since the last valuation, including decreasing the investment return rate from 7.25% to 7.00%, increasing the net 3(8)(c) transfers assumption from $480,465 to $520,000, and updating the mortality and mortality improvement rates. Changing these assumptions resulted in a net increase in the unfunded actuarial accrued liability of $11,330,399 and an increase in the employer normal cost of $33,656. The Actuarial Assumptions and Methods utilized in this valuation are detailed in Section 6, Actuarial Assumptions and Methods.

Census Data

As of January 1, 2020, there are 989 active members who may be eligible for benefits in the future, 988 retirees and beneficiaries, 261 inactives and 87 disabled retirees. Summaries of the active, retired and disabled employees are included in Section 7, Plan Member Information.

COVID-19 Pandemic

The assumptions in this report do not reflect the potential impacts of the COVID-19 pandemic on the System. Especially in the short range, the pandemic is likely to materially affect the economic and demographic assumptions on which the projections are based.

SECTION 1 - EXECUTIVE SUMMARY

A summary of principal valuation results from the current valuation and the prior valuation follows.

Valuation Date	January 1, 2020	January 1, 2018	% Change
Census Data			
Active Members	989	939	5.3%
Valuation Salary	$47,513,803	$42,190,684	12.6%
Average Salary	$48,042	$44,932	6.9%
Retired Members and Beneficiaries	988	991	(0.3%)
Total Annual Retirement Allowance	$23,642,485	$21,648,386	9.2%
Average Annual Retirement Allowance	$23,930	$21,845	9.5%
Disabled Members	87	95	(8.4%)
Total Annual Retirement Allowance	$3,231,355	$3,219,539	0.4%
Average Annual Retirement Allowance	$37,142	$33,890	9.6%
Inactive Members	261	227	15.0%
Annuity Savings Fund	$3,858,904	$3,714,606	3.9%
Funded Status			
Actuarial Accrued Liability (AAL)	$401,241,827	$375,499,583	6.9%
Market Value of Assets (MVA)	$217,948,317	$201,720,749	8.0%
Unfunded Accrued Liability on MVA	$183,293,510	$173,778,834	5.5%
Funded Status on MVA	54.3%	53.7%	1.1%
Actuarial Value of Assets (AVA)	$212,714,794	$194,942,332	9.1%
Unfunded Accrued Liability on AVA	$188,527,033	$180,557,251	4.4%
Funded Status on AVA	53.0%	51.9%	2.1%
Appropriations			
Fiscal Year 2020	N/A	$20,419,494	N/A
Fiscal Year 2021	$21,190,884	$21,190,884	0.0%
Fiscal Year 2022	$22,292,809	$21,992,165	1.4%
Fiscal Year 2023	$23,643,755	$22,824,499	3.6%

SECTION 2 - PRINCIPAL VALUATION RESULTS

Market Value of Assets

Asset information is reported annually to the Public Employee Retirement Administration Commission by the Haverhill Retirement Board. The Market Value of Assets for the three most recent calendar years are as follows:

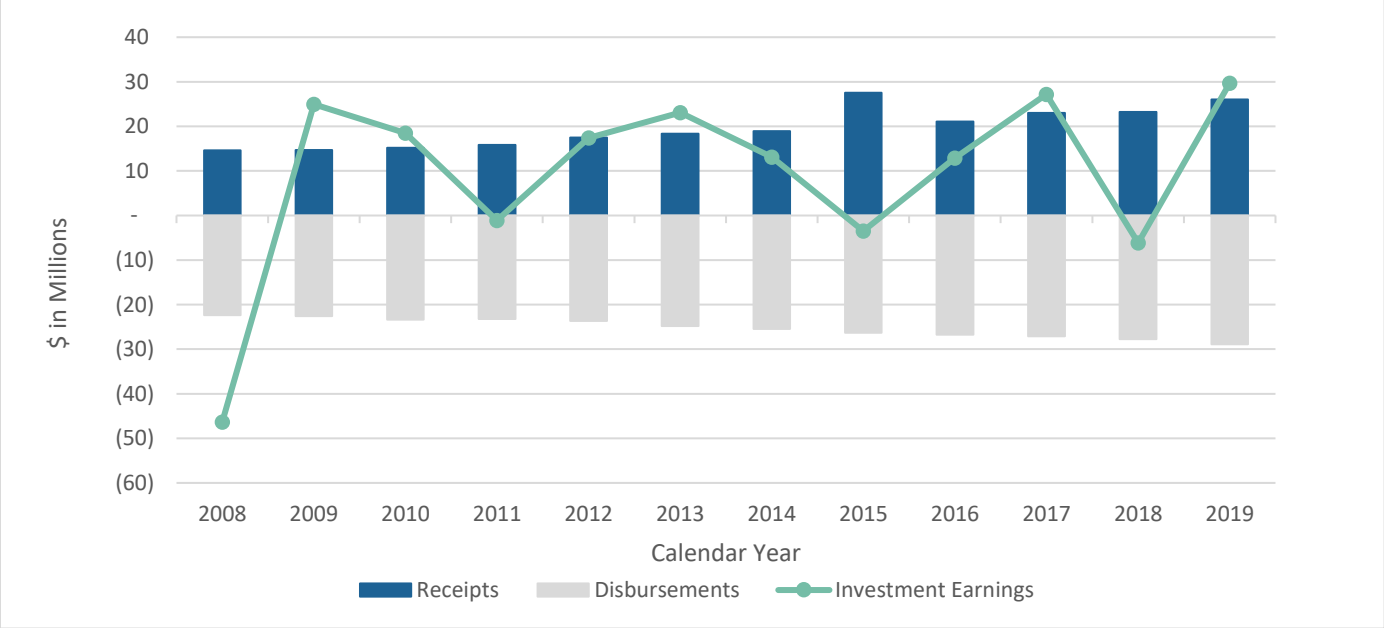
Calendar Year	2019	2018	2017
Trust Fund Composition at Year-End			
Cash	$1,383,909	$19,726,651	$10,690,420
Short-Term Investments	0	0	0
Fixed Income Securities	0	0	0
Equities	22,564,644	17,843,080	20,884,961
Pooled Short Term Funds	0	0	0
Pooled Domestic Equity Funds	0	0	28,989,614
Pooled International Equity Funds	0	11,339,787	43,998,090
Pooled Global Equity Funds	0	0	0
Pooled Domestic Fixed Income Funds	9,435,942	12,763,598	33,499,797
Pooled International Fixed Income Funds	0	0	0
Pooled Global Fixed Income Funds	0	0	0
Pooled Alternative Investments	13,635,849	12,030,354	11,156,151
Pooled Real Estate Funds	19,607,290	26,069,780	31,985,294
Pooled Domestic Balanced Funds	0	0	0
Pooled International Balanced Funds	0	0	0
Hedge Funds	0	3,411,516	20,400,313
PRIT Cash	2,203,113	0	0
PRIT Fund	149,231,274	87,920,781	0
Interest Due & Accrued	1,222	16,337	3,434
Prepaid Expenses	0	0	0
Accounts Receivable	59,156	84,152	250,433
Land	0	0	0
Buildings	0	0	0
Accumulated Depreciation - Buildings	0	0	0
Accounts Payable	(174,082)	(96,338)	(137,758)
Total Market Value of Assets	**$217,948,317**	**$191,109,698**	**$201,720,749**

SECTION 2 - PRINCIPAL VALUATION RESULTS

Market Value of Assets

Calendar Year	2019	2018	2017
Funds			
Annuity Savings Fund	$44,834,035	$45,189,164	$45,635,454
Annuity Reserve Fund	15,126,064	14,692,001	13,930,304
Special Military Service Fund	12,943	12,930	12,917
Pension Fund	13,881,252	12,483,139	12,782,235
Expense Fund	0	0	0
Pension Reserve Fund	144,094,023	118,732,464	129,359,839
Total Market Value of Assets	**$217,948,317**	**$191,109,698**	**$201,720,749**
Asset Activity			
Market Value as of Beginning of Year	$191,109,698	$201,720,749	$178,611,156
Contributions and Receipts	26,044,927	23,250,050	23,004,938
Benefit Payments and Expenses	(28,865,305)	(27,745,558)	(27,090,341)
Investment Return	29,658,997	(6,115,543)	27,194,996
Total Market Value of Assets	**$217,948,317**	**$191,109,698**	**$201,720,749**
Rate of Return	15.51%	-1.77%	16.74%

Below are the receipts and disbursements during the last 12 years. The green line reflects investment earnings, which vacillate as investment markets fluctuate. Blue bars indicate contributions, from employees and employers, and grey bars show benefit payments and administrative expenses.



SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Value of Assets

The Actuarial Value of Assets is the market value of assets as of the valuation date adjusted to phase in investment gains and losses over a 4-year period, further constrained to be within 10% of the market value of assets. Investment gains and losses are the excess or deficiency of the expected returns over the actual returns.

Valuation Date	January 1, 2020	January 1, 2019	January 1, 2018
1. Expected Market Value of Assets			
a. Market Value of Assets as of prior January 1	$191,109,698	$201,720,749	$178,611,156
b. Prior Year Contributions and Receipts	26,044,927	23,250,050	23,004,938
c. Prior Year Benefit Payments and Expenses	(28,865,305)	(27,745,558)	(27,090,341)
d. Expected Investment Return Rate	7.25%	7.25%	7.50%
e. Expected Investment Return	13,753,214	14,461,792	13,242,634
f. Expected Market Value of Assets	$202,042,534	$211,687,033	$187,768,387
2. Prior Year Gain/(Loss)			
a. Market Value of Assets as of January 1	$217,948,317	$191,109,698	$201,720,749
b. Expected Market Value of Assets	202,042,534	211,687,033	187,768,387
c. Prior Year Gain /(Loss)	$15,905,783	($20,577,335)	$14,371,416

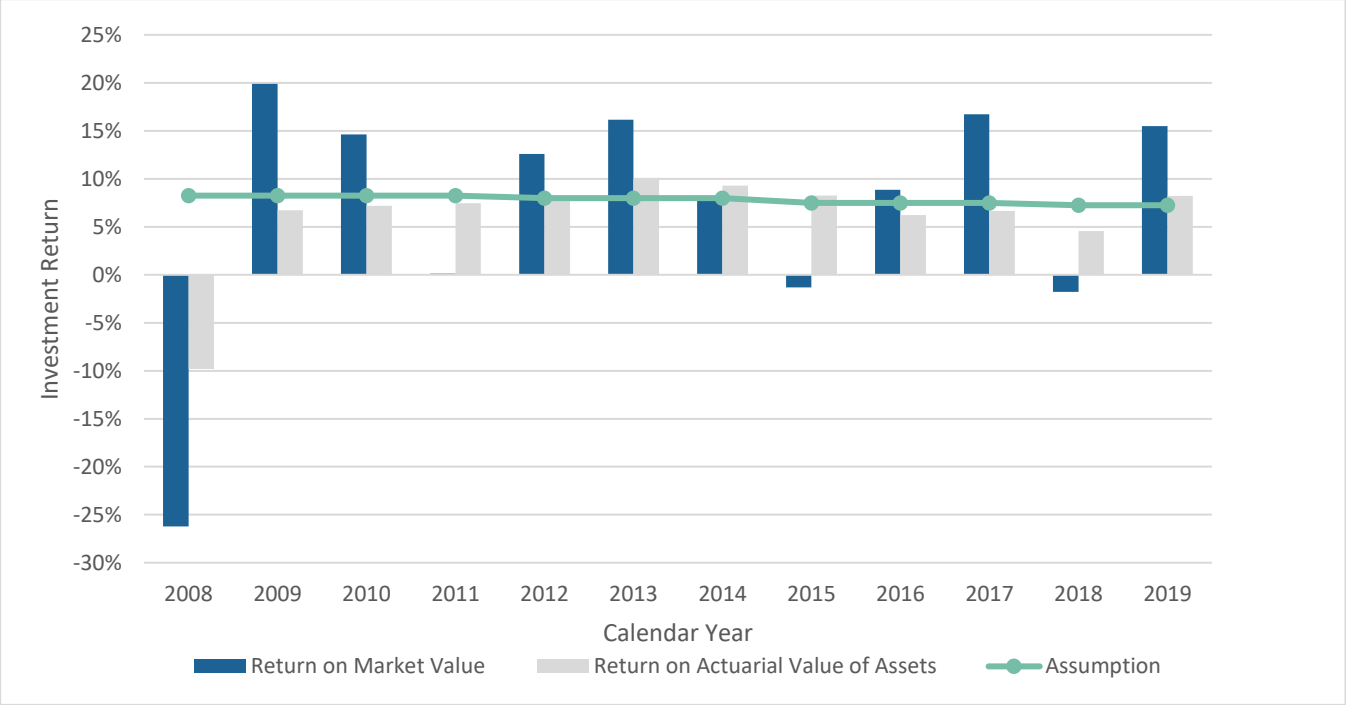
3. Phase-In of Asset Gains and Losses

	Calendar Year	Gain / (Loss)	Unrecognized Gain / (Loss)	Unrecognized Gain / (Loss)	Unrecognized Gain / (Loss)
a.	2019	$15,905,783	$11,929,337	$0	$0
b.	2018	(20,577,335)	(10,288,668)	(15,433,001)	0
c.	2017	14,371,416	3,592,854	7,185,708	10,778,562
d.	2016	493,449	0	123,362	246,725
e.	2015	(16,987,481)	0	0	(4,246,870)
f.	Total Deferred Gains/(Losses)		$5,233,523	($8,123,931)	$6,778,417

Actuarial Value of Assets

Valuation Date	January 1, 2020	January 1, 2019	January 1, 2018
4. Actuarial Value of Assets			
a. Market Value of Assets	$217,948,317	$191,109,698	$201,720,749
b. Deferred Gains/(Losses)	5,233,523	(8,123,931)	6,778,417
c. Market Value of Assets Less Deferred Gains/(Losses)	$212,714,794	$199,233,629	$194,942,332
d. 90% of Market Value of Assets	196,153,485	171,998,728	181,548,674
e. 110% of Market Value of Assets	239,743,149	210,220,668	221,892,824
f. Actuarial Value of Assets, a., but not less than b. and not greater than c.	$212,714,794	$199,233,629	$194,942,332
g. Ratio of Actuarial Value of Assets to Market Value of Assets	97.6%	104.3%	96.6%
5. Rate of Return on Actuarial Value of Assets for Prior Calendar Year	8.24%	4.56%	6.66%

Below are the investment returns during the last 12 years. The green line reflects the investment return actuarial assumption. Blue bars indicate investment return rates on market value of assets, and grey bars show investment return rates on actuarial value of assets.



SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Liabilities

The **Actuarial Present Value of Future Benefits** is the present value of the cost to finance all benefits payable in the future, discounted to reflect the probability of payment and the time value of money. Below is the Actuarial Present Value of Future Benefits from the current valuation and the prior valuation:

Valuation Date	January 1, 2020	January 1, 2018
Actives	$204,719,977	Not available
Retired Members and Beneficiaries	234,353,387	
Disabled Members	33,852,507	
Inactive Members	3,858,904	
Total Present Value of Future Benefits	**$476,784,775**	

The **Actuarial Accrued Liability** is the portion of the Actuarial Present Value of Future Benefits which is allocated to all periods prior to a valuation year and therefore is not provided for by future Normal Costs. Below is the Actuarial Accrued Liability from the current valuation and the prior valuation:

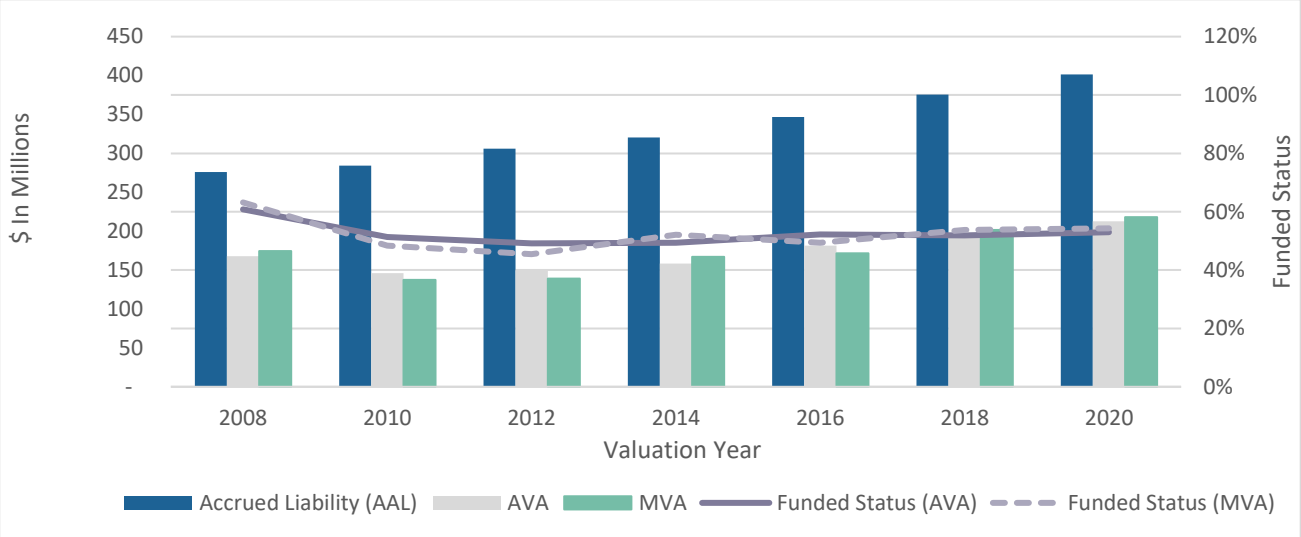
Valuation Date	January 1, 2020	January 1, 2018
Actives	$129,177,029	$126,560,018
Retired Members and Beneficiaries	234,353,387	210,679,191
Disabled Members	33,852,507	34,545,768
Inactive Members	3,858,904	3,714,606
Total Actuarial Accrued Liability	**$401,241,827**	**$375,499,583**

The **Unfunded Actuarial Accrued Liability** is the difference between the Actuarial Accrued Liability and the Actuarial Value of Assets as of the valuation date. The **Funded Status** is the Actuarial Value of Assets divided by the Actuarial Accrued Liability and is a point-in-time measurement of the amount of assets set aside to cover actuarial accrued liabilities. Below is the Unfunded Actuarial Accrued Liability and Funded Status from the current valuation and the prior valuation:

Valuation Date	January 1, 2020	January 1, 2018
Unfunded Actuarial Accrued Liability		
a. Actuarial Accrued Liability	$401,241,827	$375,499,583
b. Actuarial Value of Assets	212,714,794	194,942,332
c. Unfunded Actuarial Accrued Liability (a. - b.)	$188,527,033	$180,557,251
d. Funded Status (b. divided by a.)	53.0%	51.9%

Actuarial Liabilities

Below are the accrued liabilities, asset values (actuarial and market) and funded status for each of the last valuations. The purple solid line reflects the funded status on an actuarial value of assets (AVA) basis and the purple dotted line reflects the funded status on a market value (MVA) basis. Blue bars indicate actuarial accrued liabilities, grey bars indicate actuarial value of assets and green bars indicate market value of assets.



The **Normal Cost** is the portion of the Actuarial Present Value of Future Benefits which is allocated to a valuation year. Only active employees who have not reached Normal Retirement Age incur a Normal Cost. Below is the Normal Cost from the current valuation and the prior valuation:

Valuation Date	January 1, 2020	January 1, 2018
Total Normal Cost	$8,042,811	$5,814,946
As of Percentage of Salary	16.9%	13.8%
Employee Normal Cost	$4,354,702	$3,806,391
As of Percentage of Salary	9.2%	9.0%
Administrative Expenses	$500,000	$565,192
As a Percentage of Salary	1.1%	1.3%
Net Employer Normal Cost	$4,188,109	$2,573,747
As a Percentage of Salary	8.8%	6.1%

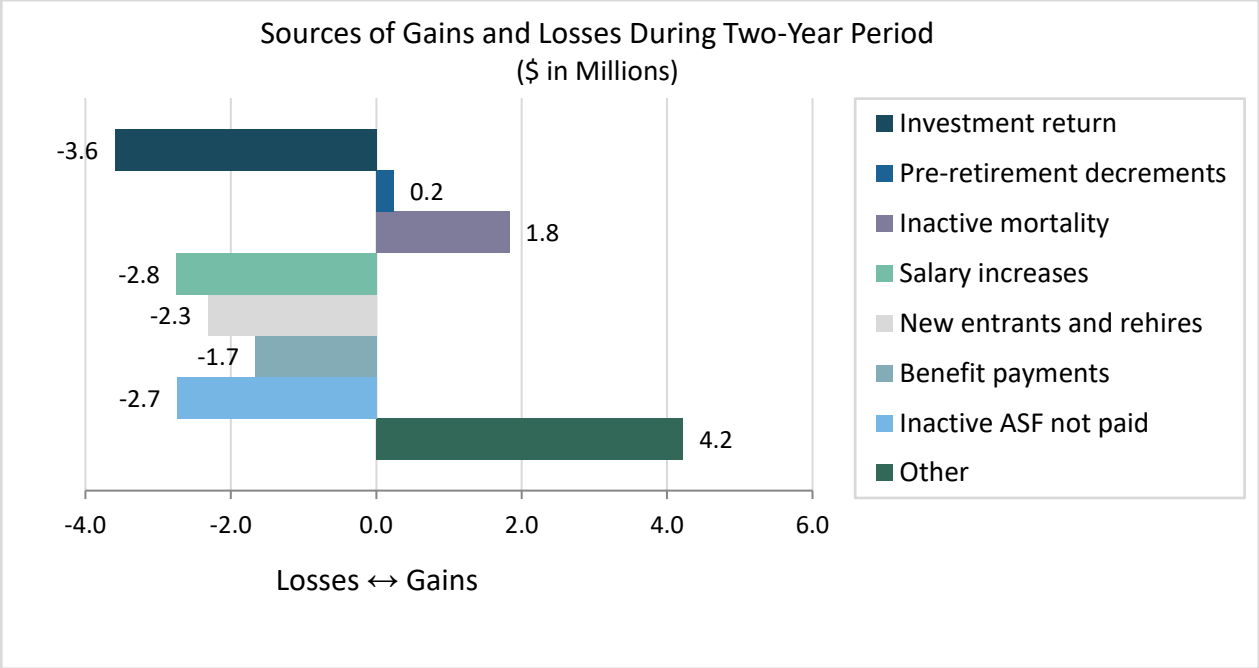
Actuarial Experience

In performing the actuarial valuation, various assumptions are made regarding mortality, retirement, disability and withdrawal rates as well as salary increases and investment returns. A comparison of the results of the current valuation and the prior valuation is made to determine how closely actual experience relates to expected. During the two years since the last valuation, the total unfunded actuarial accrued liability of the System was expected to decrease by $12,288,126. Below is the development of the Actuarial Loss for the current 2-year period:

Calendar Year Ending		December 31, 2019	December 31, 2018
Expected Unfunded Actuarial Accrued Liability			
1.	Unfunded Actuarial Accrued Liability, Beginning of Year	$175,791,317	$180,557,251
2.	Normal Cost, Beginning of Year	6,267,593	5,814,946
3.	Total Contributions	26,044,927	23,250,050
4.	Interest (full year on 1. and 2., one-half year on 3.)	12,255,142	12,669,170
5.	Expected Unfunded Actuarial Accrued Liability	$168,269,125	$175,791,317
6.	Unfunded Actuarial Accrued Liability (before changes)	175,046,477	
7.	(Gain)/Loss (6. - 5.)	$6,777,352	
Asset Gain/(Loss)			
1.	Actuarial Value of Assets, Beginning of Year	$199,233,629	$194,942,332
2.	Contributions and Receipts	26,044,927	23,250,050
3.	Benefit Payments and Expenses	(28,865,305)	(27,745,558)
4.	Assumed Rate of Return (prior valuation)	7.25%	7.25%
5.	Expected Return	14,342,199	13,970,357
6.	Actuarial Value of Assets, End of Year	$212,714,794	$199,233,629
7.	Actual Return	16,301,543	8,786,805
8.	Actual Rate of Return	8.24%	4.56%
9.	Asset Gain/(Loss) (7. - 5.)	1,959,344	(5,183,552)
10.	Total Asset Gain/(Loss), 2-Year Period	($3,600,016)	

Actuarial Experience

Below are the various sources of gains and losses over the 2-year period. The asset loss during the period was $3,600,016, and the total demographic loss during the period was $3,177,336, which totals to an overall loss of $6,777,352.



*"Other" includes a $5.75 million gain that is attributable to the change in actuarial firms.

Unfunded Actuarial Accrued Liability

1.	Changes due to:	
	a. Asset Loss	$3,600,016
	b. Demographic Experience Loss	3,177,336
	c. Total Loss Prior to Changes	6,777,352
	d. Plan Change	2,150,157
	e. Assumption Change - Change in Mortality and Mortality Improvement Rates	11,330,399
	f. Total Increase (including changes)	20,257,908
2.	Unfunded Actuarial Accrued Liability, End of Year	$188,527,033

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Annual Appropriations

The Annual Appropriation is determined in accordance with the requirements set forth in Sections 22D and 22F of Chapter 32 of the Massachusetts General Laws ("M.G.L."). The appropriation is comprised of the annual employer normal cost and amortization payments to pay the unfunded actuarial accrued liability. Below are the details of the annual appropriations for the current and prior valuations, adjusted for annual payments made July 1. The appropriations shown are based on the results of the valuation and do not account for any adjustments made to appropriations in the selected funding schedule.

	Valuation Date	January 1, 2020	January 1, 2018
1.	Early Retirement Incentive Plan (2002)		
	Fully Funded Year	2032	2032
	Investment Return Rate	7.00%	7.25%
	Balance as of Valuation Date	$4,423,859	$4,636,668
	Amortization Amount	$429,000	$401,428
	Increasing Rate	4.00%	4.00%
	Remaining Payment Period from Valuation Date	12	14
2.	Early Retirement Incentive Plan (2003)		
	Fully Funded Year	2032	2032
	Investment Return Rate	7.00%	7.25%
	Balance as of Valuation Date	$3,302,808	$3,461,689
	Amortization Amount	$320,287	$299,702
	Increasing Rate	4.00%	4.00%
	Remaining Payment Period from Valuation Date	12	14
3.	Unfunded Actuarial Accrued Liability		
	Fully Funded Year	2032	2032
	Investment Return Rate	7.00%	7.25%
	Balance as of Valuation Date	$180,800,366	$172,458,894
	Amortization Amount	$17,532,943	$15,103,982
	Increasing Rate	4.00%	3.80%
	Remaining Payment Period from Valuation Date	12	14
4.	Total Amortization Payments	$18,282,230	$15,805,112
5.	Normal Cost	$4,188,109	$2,573,747
6.	Net 3(8)(c) Transfers	$502,703	$464,483
7.	Total Appropriation as of January 1	$22,973,042	$18,843,342
8.	**Adjusted for Annual Payments as of July 1**	**$23,763,499**	**$19,514,462**

Exhibit 3.1 - 30-Year Forecast of Annual Appropriations

Fiscal Year Ending	Employer Normal Cost	Amortization Payment of UAL	Amortization Payment of ERI 2002	Amortization Payment of ERI 2003	Net 3(8)(c) Transfers	Total Employer Cost	Increase over Prior Year	Unfunded Actuarial Accrued Liability
2021	$4,153,046	$15,782,305	$443,761	$331,307	$480,465	$21,190,884		$188,527,033
2022	4,228,606	16,738,134	461,510	344,559	520,000	22,292,809	5.20%	184,596,845
2023	4,376,607	17,908,834	479,972	358,342	520,000	23,643,755	6.06%	179,370,759
2024	4,529,789	19,154,930	499,170	372,675	520,000	25,076,564	6.06%	172,534,513
2025	4,688,331	20,481,154	519,137	387,582	520,000	26,596,204	6.06%	163,896,071
2026	4,852,424	21,892,523	539,902	403,086	520,000	28,207,935	6.06%	153,245,008
2027	5,022,258	23,394,370	561,498	419,209	520,000	29,917,335	6.06%	140,350,922
2028	5,198,037	24,992,354	583,959	435,977	520,000	31,730,327	6.06%	124,961,710
2029	5,379,969	26,692,484	607,316	453,416	520,000	33,653,185	6.06%	106,801,708
2030	5,568,267	28,501,138	631,610	471,554	520,000	35,692,569	6.06%	85,569,677
2031	5,763,157	30,425,090	656,875	490,416	520,000	37,855,538	6.06%	60,936,628
2032	5,964,867	32,470,043	683,149	510,032	520,000	40,148,091	6.06%	32,543,467
2033	6,173,638	-	-	-	520,000	6,693,638	-83.33%	-
2034	6,389,715	-	-	-	520,000	6,909,715	3.23%	-
2035	6,613,355	-	-	-	520,000	7,133,355	3.24%	-
2036	6,844,823	-	-	-	520,000	7,364,823	3.24%	-
2037	7,084,392	-	-	-	520,000	7,604,392	3.25%	-
2038	7,332,346	-	-	-	520,000	7,852,346	3.26%	-
2039	7,588,977	-	-	-	520,000	8,108,977	3.27%	-
2040	7,854,591	-	-	-	520,000	8,374,591	3.28%	-
2041	8,129,502	-	-	-	520,000	8,649,502	3.28%	-
2042	8,414,034	-	-	-	520,000	8,934,034	3.29%	-
2043	8,708,526	-	-	-	520,000	9,228,526	3.30%	-
2044	9,013,325	-	-	-	520,000	9,533,325	3.30%	-
2045	9,328,791	-	-	-	520,000	9,848,791	3.31%	-
2046	9,655,298	-	-	-	520,000	10,175,298	3.32%	-
2047	9,993,234	-	-	-	520,000	10,513,234	3.32%	-
2048	10,342,997	-	-	-	520,000	10,862,997	3.33%	-
2049	10,705,002	-	-	-	520,000	11,225,002	3.33%	-
2050	11,079,678	-	-	-	520,000	11,599,678	3.34%	-

Exhibit 3.2 - 30-Year Forecast of Cash Flow

Calendar Year	Market Value of Assets, BOY	Benefit Payments	Employee Contributions	Employer Contributions	Investment Return	Market Value of Assets, EOY
2020	$217,948,317	$31,816,256	$4,354,702	$20,486,001	$15,881,662	$226,854,426
2021	226,854,426	28,738,101	4,507,117	21,513,053	16,695,388	240,831,883
2022	240,831,883	29,344,719	4,664,866	22,857,280	17,757,717	256,767,027
2023	256,767,027	29,981,233	4,828,136	24,242,430	18,959,288	274,815,648
2024	274,815,648	30,617,771	4,997,121	25,711,522	20,315,078	295,221,598
2025	295,221,598	31,104,234	5,172,020	27,269,640	21,847,780	318,406,804
2026	318,406,804	31,684,826	5,353,041	28,922,180	23,578,773	344,575,972
2027	344,575,972	32,308,736	5,540,397	30,674,865	25,524,581	374,007,079
2028	374,007,079	32,929,767	5,734,311	32,533,762	27,706,719	407,052,104
2029	407,052,104	33,479,571	5,935,012	34,505,308	30,152,685	444,165,538
2030	444,165,538	33,959,447	6,142,737	36,596,330	32,894,742	485,839,900
2031	485,839,900	35,487,622	6,357,733	38,812,625	35,928,651	531,451,287
2032	531,451,287	37,084,565	6,580,254	6,470,984	36,817,217	544,235,177
2033	544,235,177	38,753,370	6,810,563	6,679,874	37,684,425	556,656,669
2034	556,656,669	40,497,272	7,048,933	6,896,075	38,524,713	568,629,118
2035	568,629,118	42,319,649	7,295,646	7,119,843	39,331,935	580,056,893
2036	580,056,893	44,224,033	7,550,994	7,351,443	40,099,312	590,834,609
2037	590,834,609	46,214,114	7,815,279	7,591,149	40,819,379	600,846,302
2038	600,846,302	48,293,749	8,088,814	7,839,244	41,483,924	609,964,535
2039	609,964,535	50,466,968	8,371,922	8,096,023	42,083,930	618,049,442
2040	618,049,442	52,737,982	8,664,939	8,361,789	42,609,503	624,947,691
2041	624,947,691	55,111,191	8,968,212	8,636,857	43,049,802	630,491,371
2042	630,491,371	57,591,195	9,282,099	8,921,553	43,392,960	634,496,788
2043	634,496,788	60,182,799	9,606,972	9,216,213	43,626,000	636,763,174
2044	636,763,174	62,891,025	9,943,216	9,521,186	43,734,744	637,071,295
2045	637,071,295	65,721,121	10,291,229	9,836,832	43,703,716	635,181,951
2046	635,181,951	68,678,571	10,651,422	10,163,527	43,516,033	630,834,362
2047	630,834,362	71,769,107	11,024,222	10,501,656	43,153,298	623,744,431
2048	623,744,431	74,998,717	11,410,070	10,851,619	42,595,473	613,602,876
2049	613,602,876	78,373,659	11,809,422	11,213,832	41,820,751	600,073,222

Forecast Notes

Exhibit 3.1:

- The Employer Normal Cost is expected to increase 3.5% per year.
- The Unfunded Actuarial Accrued Liability ("UAL") is computed as of January 1 of each year assuming no future gains or losses.
- The Amortization Payment of UAL is an increasing payment at 4% paid over 12 years through 2032.
- The Amortization Payment of the Early Retirement Incentive Plan (2002) is an increasing payment at 4% paid over 12 year(s) through 2032.
- The Amortization Payment of the Early Retirement Incentive Plan (2003) is an increasing payment at 4% paid over 12 year(s) through 2032.
- Net 3(8)(c) transfers are a level dollar amount based on the net transfers expected to be paid by the Haverhill Retirement Board during the current year offset by the amount received during the same period.
- Total Employer Cost is the sum of the Employer Normal Cost, net 3(8)(c) transfers and the Amortization of the UAL, all computed as of January 1 of each year and adjusted for annual payments made on July 1.
- For fiscal year 2021, we show the actual appropriation developed under the previous funding schedule of $21,190,884. For fiscal years 2022 and later, the Board has selected a funding schedule that fully amortizes the unfunded actuarial accrued liability by 2032, with annual employer costs limited to increases of 5.2% in FY2022 and 6.06% thereafter over the prior year.

Exhibit 3.2:

- Expected benefit payments include payments expected to be made to retired members, beneficiaries, disabled members and active members expected to retire. In addition, expected benefit payments include distribution of the annuity savings fund attributed to inactive members.
- Benefit payments exclude cost-of-living increases granted to members in pay status between 1982 and 1997. In addition, benefit payments are as expected for the first ten years of the forecast, then increase by the greater of 4.5% per year thereafter or the expected future payments for the current population projected by our computer model.
- Calendar year cash flow entries are developed as of each January 1.

SECTION 4 - DISCLOSURES

4.1 - GASB 67 and GASB 68 Disclosures

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, *Financial Reporting for Pension Plans* , replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, *Accounting and Financial Reporting for Pensions* , replaced the requirements of Statement No. 27.

The pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

GASB 67 requires defined benefit pension plans, such as the Haverhill Retirement System, to present a statement of fiduciary net position (pension plan assets) and a statement of changes in fiduciary net position. Further, the statement requires that notes to financial statements include descriptive information such as the types of benefits provided, the classes of plan members covered and the composition of the pension plan's retirement board. Finally, GASB 67 requires pension plans to present in required supplementary information the sources of the changes in the net pension liability and information about the actuarially determined contributions compared with the actual contributions made to the plan and related ratios.

GASB 67 and GASB 68 require projected benefit payments be discounted to their actuarial present value using the single rate that reflects:

(1) a long-term expected rate of return on pension plan investments *to the extent that the pension plan's assets are sufficient to pay benefits and pension plan assets are expected to be invested using a strategy to achieve that return and*

(2) a tax-exempt, high-quality municipal bond rate *to the extent that the conditions for use of the long-term expected rate of return are not met.*

GASB 68 establishes standards for measuring and recognizing liabilities, deferred outflows of resources, deferred inflows of resources and pension expense by state and local governments.

The effective date for GASB 67 is for plan years beginning after June 15, 2013, which is the fiscal year ending December 31, 2014 for the Haverhill Retirement System. The effective date for GASB 68 is for employers' fiscal years beginning after June 15, 2014. The GASB report, submitted under separate cover and prepared as of December 31, 2019 (the measurement date), presents information to assist the Haverhill Retirement Board in providing the required information under GASB 68 to participating employers.

4.2 - PERAC Disclosure Information

The most recent actuarial valuation of the System was prepared by KMS Actuaries, LLC as of January 1, 2020.

Normal Cost - Employees	$4,354,702	9.2% of payroll
Normal Cost - Employers	$4,188,109	8.8% of payroll
Actuarial Liability - Active Members	$129,177,029	32% of total AAL
Actuarial Liability - Retired and Inactive Members	272,064,798	68% of total AAL
Total Actuarial Liability (AAL)	$401,241,827	
System Assets	$212,714,794	
Unfunded Actuarial Accrued Liability	$188,527,033	
Funded Status	53.0%	

Principal actuarial assumptions used in the valuation:

Investment Return	7.00%
Rate of Salary Increase	Based on service, 6% graded down to 4.25% for Group 1
	Based on service, 7% graded down to 4.75% for Group 4

4.3 - Risk Measures

The Haverhill Retirement System is subject to certain risks that could affect the plan's future financial condition. Here we identify the primary risks to the System, provide some background information about those risks, and provide an assessment of those risks in accordance with Actuarial Standards of Practice (ASOP) 51.

Risk is the potential of actual future measurements deviating from expected future measurements resulting from actual future experience deviating from actuarially assumed experience. Examples of potential risks that may be reasonably anticipated to significantly affect the future financial condition of the plan include the following:

- **Investment Risk** - the potential that investment returns will be different than expected.
- **Asset/Liability Mismatch Risk** - the potential that changes in asset values are not matched by changes in the value of liabilities.
- **Interest Rate Risk** - the potential that interest rates will be different than expected.
- **Longevity and Other Demographic Risks** - the potential that mortality or other demographic experience will be different than expected.
- **Contribution Risk** - the potential of actual future contributions deviating from expected future contributions. For example, that actual contributions are not made in accordance with the plan's funding policy, that other anticipated payments to the plan are not made, or that material changes occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base.

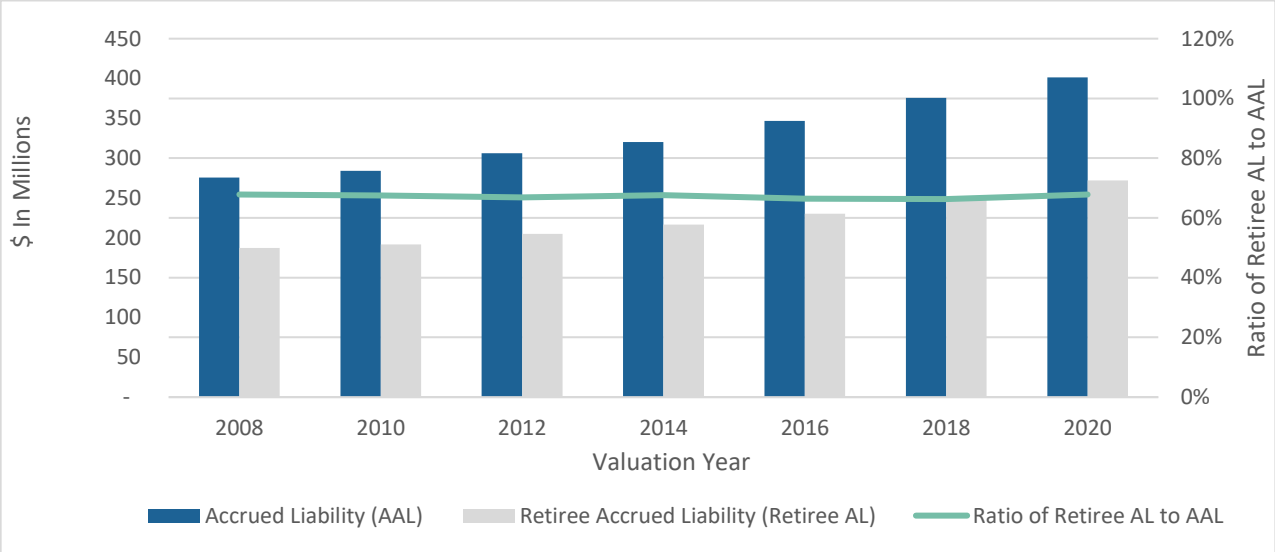
We have provided several risk measures in this section that we believe are most significant for the plan. However, we believe that a more rigorous assessment of risk would be beneficial to the Board to understand the risks identified above, such as:

- Scenario Test - a process for assessing the impact of one possible event, or several simultaneous or sequentially occurring possible events, on a plan's financial condition.
- Sensitivity Test - a process for assessing the impact of a change in an actuarial assumption on an actuarial measurement.
- Stochastic Modeling - a process for generating numerous potential outcomes by allowing for random variations in one or more inputs over time for the purpose of assessing the distribution of those outcomes.
- Stress Test - a process for assessing the impact of adverse changes in one or relatively few factors affecting a plan's financial condition.

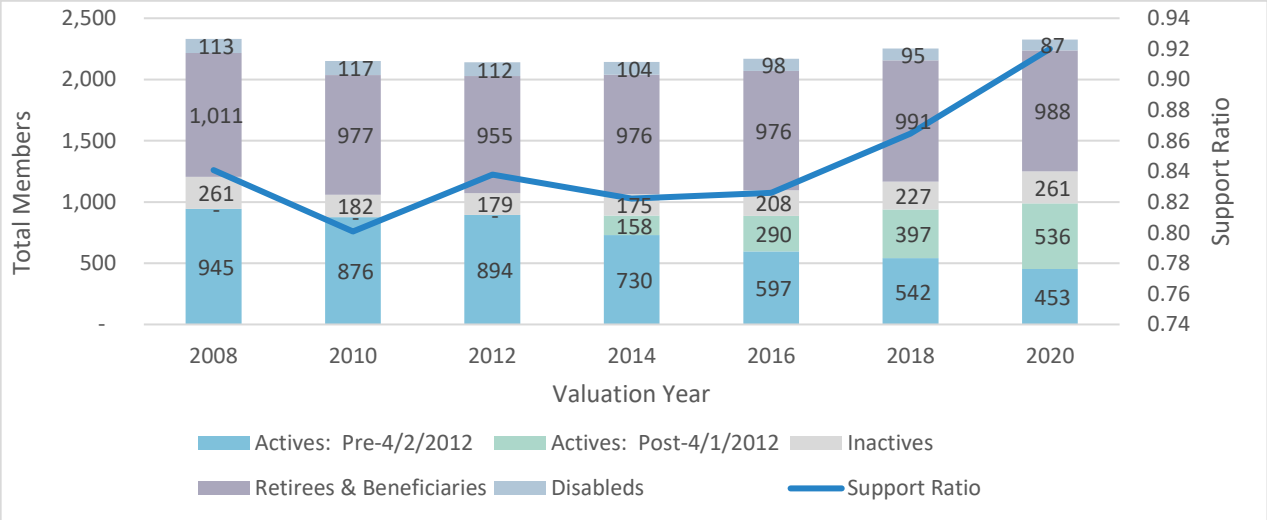
4.3 - Risk Measures

Maturity Measures

As retirement systems mature they become much more sensitive to risks. This is because a higher proportion of the actuarial liability is attributable to participants who are no longer active. Plan maturity measures are helpful in understanding the risks associated with a plan. One such maturity measure is the ratio of the system's retiree liability to its total liabiity. A retirement system in its infancy will have a very low ratio of retiree liability to total liability. As the system matures, the ratio starts increasing. A mature plan will often have a ratio above 60%. For the Haverhill Retirement System and other retirement systems in the United States these ratios have been steadily increasing in recent years.



Another maturity measure is the ratio of actives to retirees, or support ratio. A retirement system in its infancy will have a very high ratio of active to retired members. As the system matures, and members retire, the support ratio starts declining. A mature system will often have a support ratio near or below one.



4.3 - Risk Measures

Volatility Indices

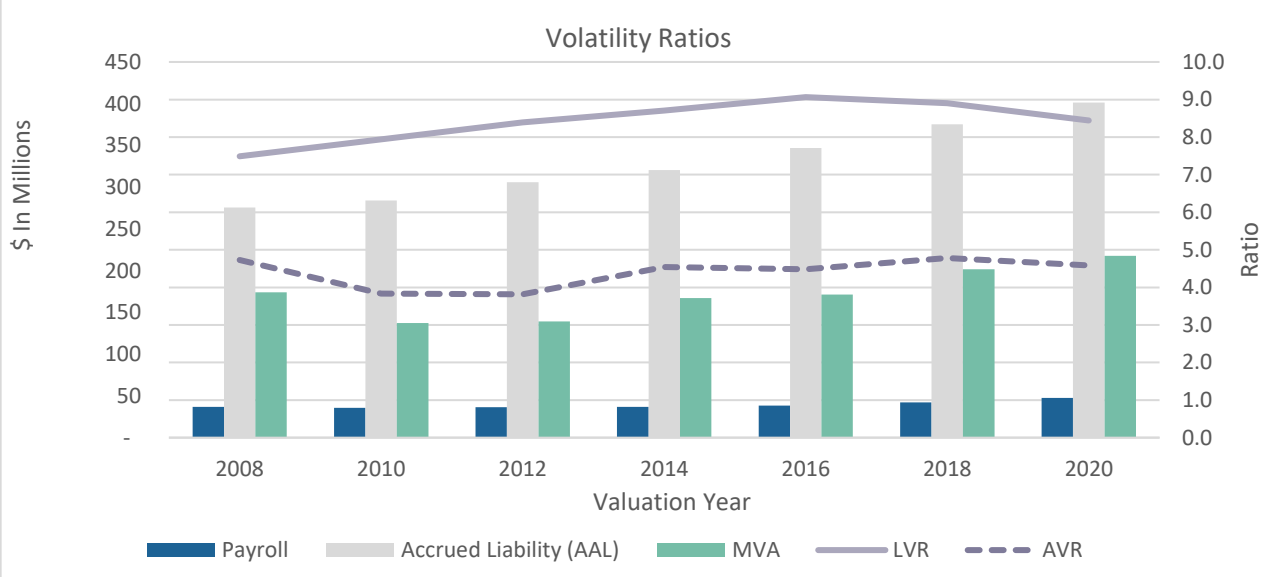
Volatility indices are measures of the relative sensitivity of employer contributions to changes in assets or liabilities. Below we present two such indices - the Asset Volatility Ratio (AVR) and the Liability Volatility Ratio (LVR):

Asset Volatility Ratio (AVR)

The Asset Volatility Ratio (AVR) is the ratio of the Market Value of Assets (MVA) to Payroll. Systems with a higher AVR experience more volatile employer contributions (as a percentage of payroll) due to investment return. This ratio indicates a measure of the system's current contribution volatility. The AVR increases over time but generally tends to stabilize as the system matures.

Liability Volatility Ratio (LVR)

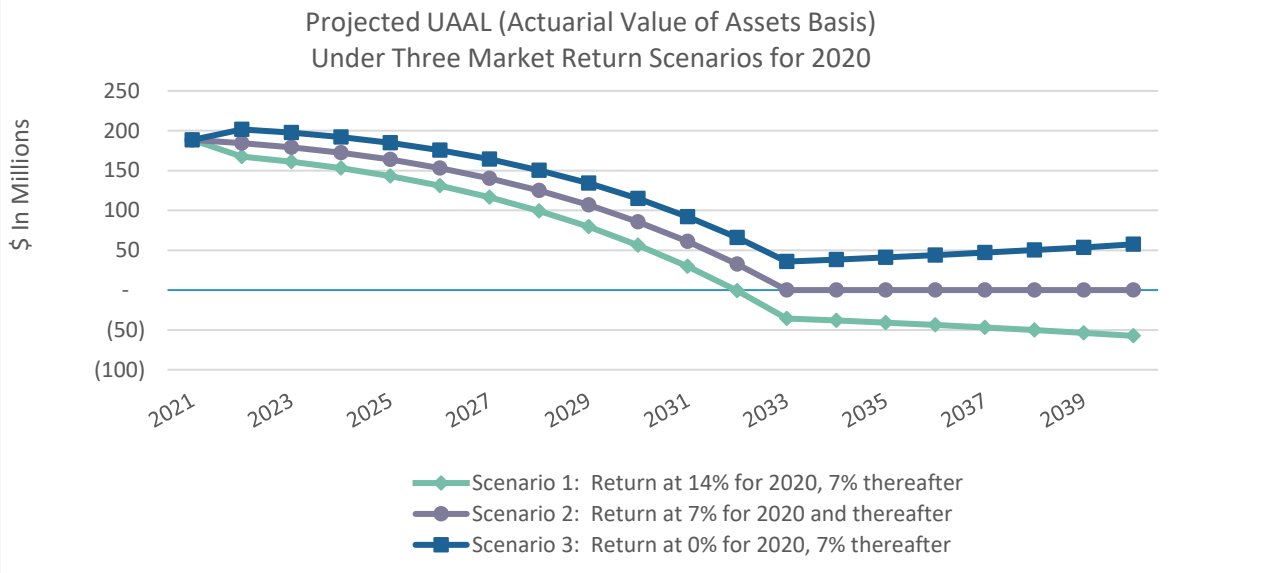
The Liability Volatility Ratio (LVR) is the ratio of the Actuarial Accrued Liability (AAL) to Payroll. Systems with a higher LVR experience more volatile employer contributions (as a percentage of payroll) due to the investment return assumption and changes in liability. This ratio indicates a longer-term potential for contribution volatility. The AVR, described above, will tend to move close to the LVR as the system matures.



4.3 - Risk Measures

Market Return Scenarios

Below we illustrate the projected effect on funding levels of a single year of investment return above or below the assumed investment return. Scenario 1 assumes a one-year return of 2 times the assumed return and the expected return thereafter, Scenario 2 assumes assets earn the expected return every year and Scenario 3 assumes a one-year return of 0% and the expected return thereafter.



Sensitivity Analysis

The following presents the Actuarial Accrued Liability and Funded Status calculated using the investment return rate of 7%, as well as what the Actuarial Accrued Liability and Funded Status would be if it were calculated using an investment return rate 1-percentage point lower (6%) or 1-percentage point higher (8%) than the assumed investment return rate:

	1% Decrease (6.0%)	Current Investment Return Rate (7.0%)	1% Increase (8.0%)
Actuarial Accrued Liability	$443,937,346	$401,241,827	$365,005,870
% Change	11%		-9%
Actuarial Value of Assets	$212,714,794	$212,714,794	$212,714,794
Unfunded Actuarial Accrued Liability	231,222,552	188,527,033	152,291,076
% Change	23%	N/A	-19%
Funded Status	47.9%	53.0%	58.3%

4.3 - Risk Measures

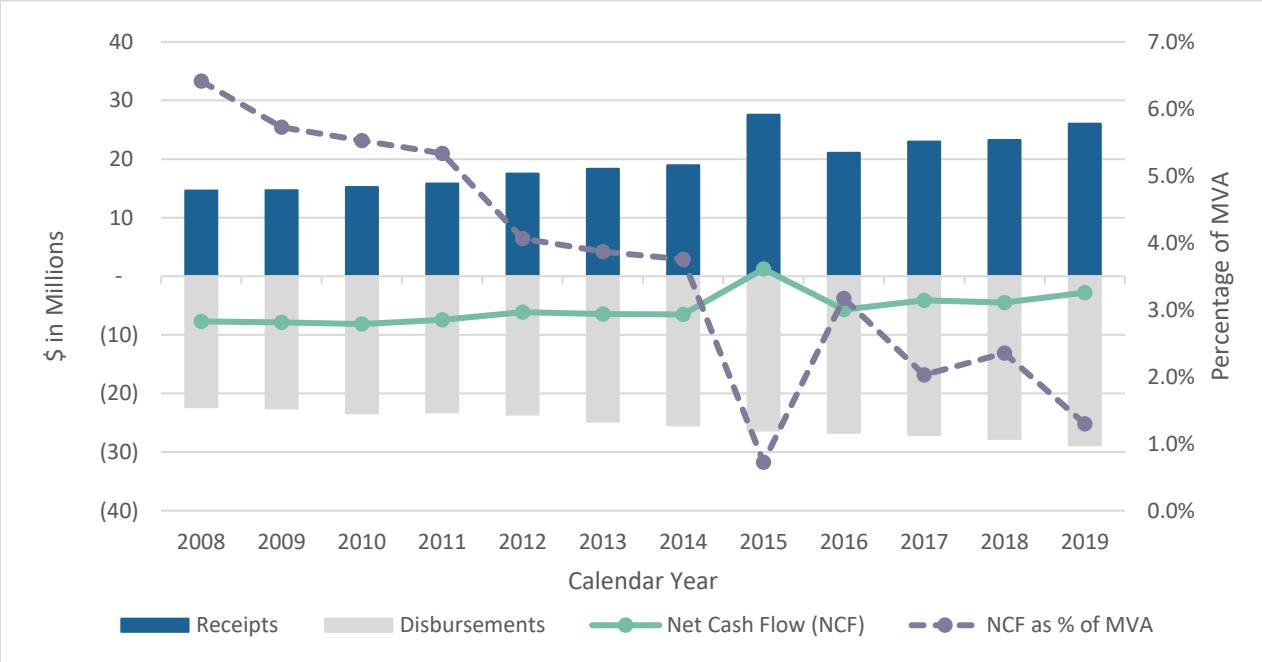
Duration

Duration is another measure that is used to describe how the present value of a cash flow series changes when small changes are made to the underlying interest rates. The duration of the Haverhill Retirement System is 10, and this represents an approximate percentage change in the Actuarial Accrued Liability for each 1% change to the investment return rate.

Net Cash Flow (NCF)

Net cash flow (NCF) during a year is the difference between contributions, both employer and employee, paid into the System and benefit payments and expenses paid from the System. If the level of benefit payments plus expenses is greater than contributions, then the System has negative NCF. Mature plans generally have a negative NCF as the number of retirees grows. When a System has negative NCF, then additional cash from existing assets are needed to pay the pension benefits.

Historical NCF since 2008 is shown in the next graph. Blue bars indicate contributions, from employees and employers, and grey bars show benefit payments and administrative expenses. The NCF is represented by the green line. The dashed purple line (which corresponds to the right-hand axis) provides the NCF as a percentage of the Market Value of Assets. As of December 31, 2019, the NCF was negative $2.8 million, which represents 1.3% of the Market Value of Assets. The NCF falls within the range of .7% to 6.4% of total assets over the 12-year period.



SECTION 5 - SUMMARY OF PLAN PROVISIONS

Administration

There are 104 contributory retirement systems for public employees in Massachusetts. Each system is governed by a retirement board and all boards, although operating independently, are governed by Chapter 32 of the Massachusetts General Laws and other applicable statutes. This law in general provides uniform benefits, uniform contribution requirements and a uniform accounting and funds structure for all systems.

Participation

Participation is mandatory for all full-time employees. Eligibility with respect to part-time, provisional, temporary, seasonal or intermittent employment is governed by regulations promulgated by the local retirement board, and approved by PERAC. Membership is optional for certain elected officials.

Membership Groups

There are four membership groups in the Retirement System:

Group 1	General employees, including clerical, administrative, technical and all other employees not otherwise classified.
Group 2	Certain specified hazardous duty positions.
Group 3	State police officers and inspectors.
Group 4	Local police officers, firefighters and other specified hazardous positions.

For members in more than one group, participation will be proportional.

Member Contributions

Member contributions vary depending on the most recent date of membership:

Prior to 1975	5% of Salary
1975 – 1983	7% of Salary
1984 – June 30, 1996	8% of Salary
July 1, 1996 – present	9% of Salary
1979 – present	An additional 2% of Salary in excess of $30,000.
Group 1 members hired on or after April 2, 2012	6% of Salary with 30 or more years of creditable service.

Rate of Interest

Interest on regular deductions made after January 1, 1984 is a rate established by PERAC in consultation with the Commissioner of Banks. The rate is obtained from the average rates paid on individual savings accounts by a representative sample of at least ten financial institutions.

Retirement Age

The mandatory retirement age for some Group 2 and Group 4 members is age 65. Most Group 2 and Group 4 members may remain in service after reaching age 65. Group 4 members who are employed in certain public safety positions are required to retire at age 65. There is no mandatory retirement age for members in Group 1.

Salary

Gross regular compensation. This does not include bonuses, overtime, severance pay, unused sick leave credit or other similar compensation.

Average Salary

Membership before April 2, 2012

- Average annual rate of regular compensation received during the three consecutive years that produce the highest average, or, if greater, during the last three years (whether or not consecutive) preceding retirement.

Membership on or after April 2, 2012

- Average annual rate of regular compensation received during the five consecutive years that produce the highest average, or, if greater, during the last five years (whether or not consecutive) preceding retirement.

Creditable Service

The period during which a member contributes to the retirement system plus certain periods of military service and "purchased" service.

Benefit Rate

The benefit rate varies with the member's retirement age, Group, membership date and years of creditable service at retirement. Each year a member retires prior to the age at which the 2.5% maximum benefit rate applies, a reduction is applied to each year of age under the maximum age. The maximum age and reduction for each Group and membership date is as follows:

	Group 1	Group 2	Group 4
2.5% for Membership before April 2, 2012:			
Maximum age:	65	60	55
Reduction:	0.1%	0.1%	0.1%
2.5% for Membership on or after April 2, 2012 (less than 30 years of service):			
Maximum age:	67	62	57
Reduction:	0.15%	0.15%	0.15%
2.5% for Membership on or after April 2, 2012 (30+ years of service):			
Maximum age:	67	62	57
Reduction:	0.125%	0.125%	0.125%

Superannuation Retirement	Eligibility if membership before April 2, 2012	♦ completion of 20 years of Creditable Service, or ♦ attainment of age 55 if hired prior to 1978, or ♦ attainment of age 55 with 10 years of Creditable Service, if hired after 1978.
	Eligibility if membership on or after April 2, 2012	♦ attainment of age 60 with 10 years of Creditable Service if classified in Group 1 ♦ attainment of age 55 with 10 years of Creditable Service if classified in Group 2 ♦ attainment of age 55 if classified in Group 4
	Benefit Amount	Product of the member's Benefit Rate, Average Salary and Creditable Service.
	Maximum Benefit	80% of the member's Average Salary.
	Veteran's Benefit	Additional benefit of $15 per year of Creditable Service, up to a maximum of $300.
Deferred Vested	Eligibility	♦ completion of ten or more years of Creditable Service. ♦ elected officials hired prior to 1978, completion of six years of Creditable Service.
	Benefit Amount	Accrued benefit payable commencing at age 55, or the completion of 20 years of Creditable Service, or may be deferred until later at the participant's option.
Withdrawal of Contributions		Contributions may be withdrawn upon termination of employment. ♦ Members hired on or after January 1, 1984 who terminate with less than ten years of Creditable Service receive contributions plus interest on the Annuity Savings Account at an annual rate of 3%. ♦ All other withdrawals receive contributions plus 100% of the regular interest that has accrued to the Annuity Savings Account.

Ordinary Disability Retirement	Eligibility	Non-job related disability after completion of ten years of Creditable Service.
	Benefit Amount for Group 1 membership before April 2, 2012 or Group 2 or Group 4	Superannuation benefit determined if the member is age 55, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
	Benefit Amount for Group 1 membership on or after April 2, 2012	Superannuation benefit determined if the member is age 60, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
Accidental Disability Retirement	Eligibility	Disabled as a result of an accident in the performance of duties. There is no minimum age or service requirement.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of $15 per year of Creditable Service, up to a maximum of $300.
	Supplemental Dependent Allowance	Additional allowance of $952.32 per year for each child until age 18 (or age 22 if a full-time student).
Non-Occupational Death	Eligibility	For members with at least two years of creditable service who die while in active service, but not due to occupational injury.
	Benefit Amount	Benefit as if Option C had been elected. Minimum benefit of $250 per month for surviving spouse, $120 per month for first child and $90 per month for each additional child.

Accidental Death	Eligibility	For members who die as a result of an occupational injury.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of $15 per year of creditable service, up to a maximum of $300.
	Supplemental Dependent Allowance	Additional allowance of $952.32 per year for each child until age 18 (or age 22 if a full-time student).

Cost-of-Living Adjustment (COLA)

In accordance with the adoption of Chapter 17 of the Acts of 1997, the granting of a Cost-of-Living Adjustment will be determined by an annual vote by the Retirement Board. The amount of increase will be based upon the Consumer Price Index, limited to a maximum of 3.0%, beginning on July 1. All retirees, disabled retirees and beneficiaries who have been receiving benefit payments for at least one year as of July 1 are eligible for the adjustment. The maximum amount of pension benefit subject to a COLA is $13,000. All COLAs granted to members after 1981 and prior to July 1, 1998 are deemed to be an obligation of the Commonwealth of Massachusetts and are not the liability of the Retirement System.

Optional Forms of Payment

A member may elect to receive his or her retirement allowance, payable in monthly installments, in one of three forms of payment:

- Option A – Total annual allowance commencing at retirement and terminating at member's death.

- Option B – A reduced annual allowance commencing at retirement with death benefit equal to excess of member contributions plus credited interest to retirement over annuity benefit paid to member.

- Option C – A reduced annual allowance commencing at retirement with 66⅔% of benefit continued to designated beneficiary upon death of member. For members who retired on or after January 12, 1988, if the beneficiary pre-deceases the retiree, the benefit payable increases based on the factor used to determine the Option C benefit at retirement. For members who retired prior to January 12, 1988, if the System has accepted Section 288 of Chapter 194 of the Acts of 1998 and the beneficiary pre-deceases the retiree, the benefit payable increases based on the factor used to determine the Option C benefit at retirement.

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Valuation Date

January 1, 2020

Investment Return

7.00% per year. Previously, 7.25% per year.

The investment return assumption is a long-term assumption based on capital market expectations by asset class, historical returns and professional judgment. We considered analysis prepared by PRIM's investment advisor using a building block approach and using the target asset allocation, expected returns by asset class and risk analysis to determine a long-term expected average annual rate of return.

Annuity Savings Fund Interest Rate

2.00% per year

Amortization Method

Unfunded Actuarial Accrued Liability (UAL):

Increasing dollar amount at 4% to reduce the Unfunded Actuarial Accrued Liability to zero on or before June 30, 2032. Further, annual appropriation increases are limited to 5.2% for FY2022 and 6.06% thereafter until 2032.

Salary Scale

The assumed annual rates for salary increases including longevity are illustrated by the following rates:

Years of Service	Groups 1 and 2	Group 4
0	6.00%	7.00%
1	5.50%	6.50%
2	5.50%	6.00%
3	5.25%	5.75%
4	5.25%	5.25%
5	4.75%	5.25%
6	4.75%	4.75%
7	4.50%	4.75%
8	4.50%	4.75%
9+	4.25%	4.75%

The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations and professional judgment.

Cost-of-Living Allowance

Cost-of-Living Allowances (COLA) are assumed to be 3% of the pension amount, capped at $390 per year.

Mortality Rates

RP-2014 Blue Collar Mortality Table with full generational mortality improvement using Scale MP-2018. For disabled members, RP-2014 Blue Collar Mortality Table set forward one year with full generational mortality improvement using Scale MP-2018.

General Employees: 55% of deaths are job-related.
Police and Fire: 90% of deaths are job-related.

PERAC completed a local system retiree mortality study in 2019 and selected the RP-2014 Blue Collar Mortality Table with full generational mortality improvement using Scale MP-2018. The underlying tables with generational mortality improvement selected reasonably reflect the mortality experience of the System as of the valuation date based on historical and current demographic data as well as professional judgement.

Turnover Rates

Illustrative turnover rates are shown below:

Creditable Service	Groups 1 and 2	Group 4
0	0.1500	0.0150
10	0.0540	0.0150
20	0.0200	0.0000
30	0.0000	0.0000

Disability Rates

Illustrative disability rates are shown below:

Attained Age	Groups 1 and 2	Group 4
20	0.0001	0.0010
30	0.0003	0.0030
40	0.0010	0.0030
50	0.0019	0.0125
60	0.0028	0.0085

General Employees: 55% of disabilities are accidental and 45% are ordinary.
Police and Fire: 90% of disabilities are accidental and 10% are ordinary.

Retirement Rates

Illustrative retirement rates are shown below:

Attained Age	Groups 1 and 2		Group 4
	Male	Female	Male & Female
50	0.0100	0.0150	0.0200
51	0.0100	0.0150	0.0200
52	0.0100	0.0200	0.0200
53	0.0100	0.0250	0.0500
54	0.0200	0.0250	0.0750
55	0.0200	0.0550	0.1500
56	0.0250	0.0650	0.1000
57	0.0250	0.0650	0.1000
58	0.0500	0.0650	0.1000
59	0.0650	0.0650	0.1500
60	0.1200	0.0500	0.2000
61	0.2000	0.1300	0.2000
62	0.3000	0.1500	0.2500
63	0.2500	0.1250	0.2500
64	0.2200	0.1800	0.3000
65	0.4000	0.1500	1.0000
66	0.2500	0.2000	1.0000
67	0.2500	0.2000	1.0000
68	0.3000	0.2500	1.0000
69	0.3000	0.2000	1.0000
70	1.0000	1.0000	1.0000

The turnover, disability and retirement rates are based on PERAC's most recent experience analysis of local retirement systems which reviewed age, gender and job group. The assumptions reflect this analysis as well as professional judgment.

Actuarial Cost Method

Individual Entry Age Normal.

Actuarial Asset Method

The Actuarial Value of Assets is the market value of assets as of the valuation date reduced by the sum of:

a) 75% of gains and losses of the prior year,
b) 50% of gains and losses of the second prior year, and
c) 25% of gains and losses of the third prior year.

Investment gains and losses are determined by the excess or deficiency of the expected return over the actual return on the market value. The actuarial valuation of assets is further constrained to be not less than 90% or more than 110% of market value.

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Census Data	Census data as of the valuation date were submitted by the Retirement Board.
Asset Data	Asset information is reported annually to the Public Employee Retirement Administration Commission by the Haverhill Retirement Board.
Dependents	80% of all members will be survived by a spouse. Age assumption for spouses is that males are assumed to be three years older than females.
Net Section 3(8)(c) Transfers	Reimbursements paid to and received from other retirement systems for that portion of a retiree's pension that is based on service earned in another retirement system. Net 3(8)(c) transfers are assumed to be $520,000 per year.
Administrative Expenses	The anticipated administrative expenses for the fiscal year. For Fiscal Year 2021, the administrative expenses were assumed to be $500,000 and are anticipated to increase 3.5% per year. The administrative expense assumption is based on information relating to the System's administrative expenses provided by the Retirement System.

SECTION 7 - PLAN MEMBER INFORMATION

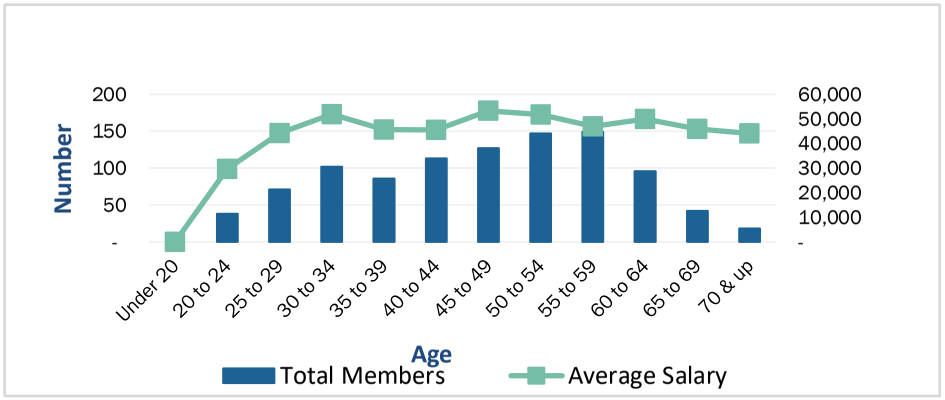
Exhibit 7.1 - Summary of Census Data as of January 1, 2020

Census data as of December 31, 2019 was provided to us by the Retirement Board. We performed edits on the data to ensure that it is reasonable and complete and made certain assumptions regarding any missing or invalid data so that results are not materially affected. Presented on the following pages are summaries of the demographic profile of active members (Exhibit 7.2) and retired plan members and beneficiaries and disabled plan members (Exhibit 7.3). Below, we present a comparison of the census data from the current and prior valuations:

Valuation Date	January 1, 2020	January 1, 2018	% Change
Census Data			
Active Members	989	939	5.3%
Average Age	47.0	47.3	(0.5%)
Average Service	10.6	11.9	(11.1%)
Valuation Salary	$47,513,803	$42,190,684	12.6%
Average Salary	$48,042	$44,932	6.9%
Retired Members and Beneficiaries	988	991	(0.3%)
Average Age	73.5	Not available	
Total Annual Retirement Allowance	$23,642,485	$21,648,386	9.2%
Average Annual Retirement Allowance	$23,930	$21,845	9.5%
State Reimbursed COLAs	$62,283	Not available	
Total System-Funded Retirement Allowance	$23,580,202	$21,648,386	8.9%
Disabled Members	87	95	(8.4%)
Average Age	69.9	Not available	
Total Annual Retirement Allowance	$3,231,355	$3,219,539	0.4%
Average Annual Retirement Allowance	$37,142	$33,890	9.6%
State Reimbursed COLAs	$35,263	Not available	
Total System-Funded Retirement Allowance	$3,196,092	$3,219,539	(0.7%)
Inactive Members	261	227	15.0%
Annuity Savings Fund	$3,858,904	$3,714,606	3.9%

Exhibit 7.2 - Active Members by Age and Years of Service as of January 1, 2020

Attained Age	Years of Service 0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total	Total Salary	Average Salary
Under 20	-	-	-	-	-	-	-	-	-	-	-	-
20 to 24	38	-	-	-	-	-	-	-	-	38	1,125,560	29,620
25 to 29	60	11	-	-	-	-	-	-	-	71	3,141,366	44,245
30 to 34	64	35	3	-	-	-	-	-	-	102	5,292,785	51,890
35 to 39	54	17	9	6	-	-	-	-	-	86	3,923,997	45,628
40 to 44	58	18	14	17	6	-	-	-	-	113	5,143,591	45,519
45 to 49	45	26	11	17	22	5	1	-	-	127	6,767,448	53,287
50 to 54	37	25	18	16	22	20	9	-	-	147	7,610,446	51,772
55 to 59	29	29	19	24	19	16	11	2	-	149	6,994,226	46,941
60 to 64	15	15	12	13	13	11	10	5	2	96	4,793,511	49,932
65 to 69	8	3	5	4	8	5	3	2	4	42	1,927,201	45,886
70 & up	3	-	3	1	3	3	2	2	1	18	793,672	44,093
Total	411	179	94	98	93	60	36	11	7	989	47,513,803	48,042
Average Salary	37,509	49,279	44,476	53,344	68,652	60,302	75,092	62,567	67,681			
					Average Age:		47.0	Average Service:		10.6		



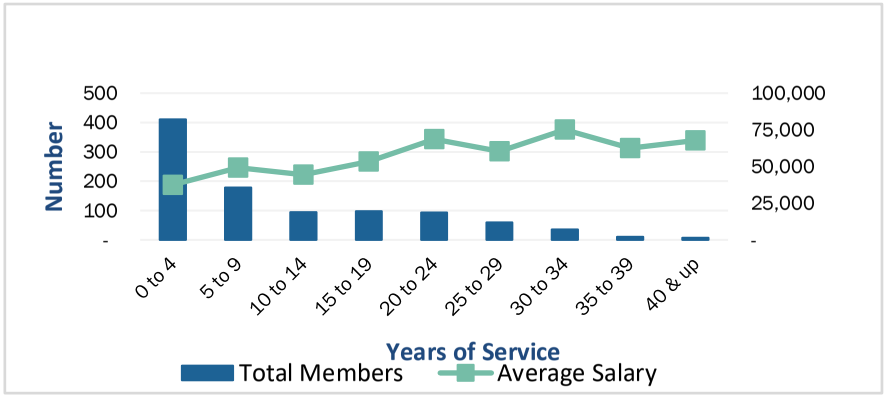
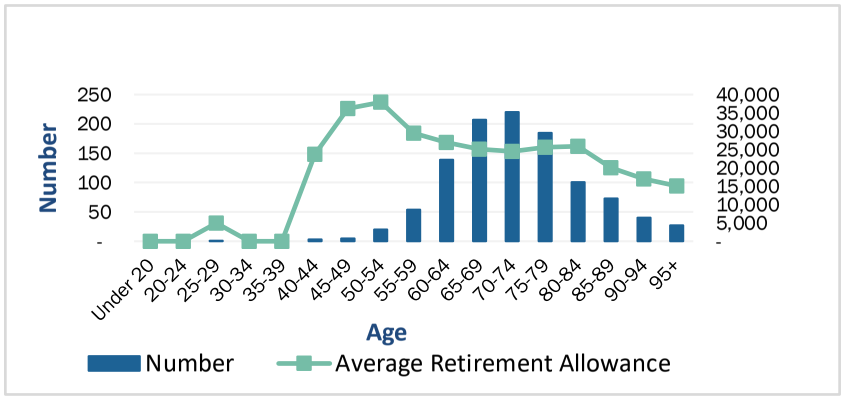
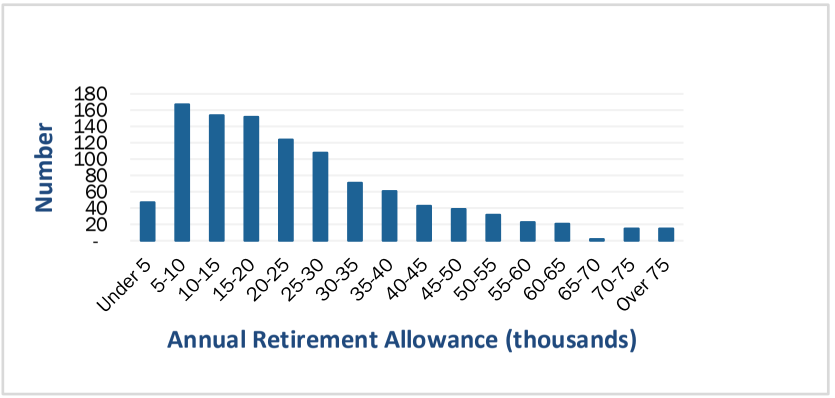


Exhibit 7.3 - Annual Retirement Allowances as of January 1, 2020

Attained Age	Service Retirements		Disability Retirements		Beneficiaries	
	Number	Annual Retirement Allowance	Number	Annual Retirement Allowance	Number	Annual Retirement Allowance
Under 20	0	0	0	0	0	0
20-24	0	0	0	0	0	0
25-29	0	0	0	0	1	4,944
30-34	0	0	0	0	0	0
35-39	0	0	0	0	0	0
40-44	0	0	1	60,125	2	10,996
45-49	1	41,009	2	104,154	2	36,017
50-54	6	179,107	9	394,186	5	184,980
55-59	42	1,161,544	7	345,007	5	86,380
60-64	120	3,141,510	7	297,354	12	311,814
65-69	184	4,614,518	14	457,264	9	129,507
70-74	189	4,637,698	14	437,275	17	315,747
75-79	150	3,722,517	19	679,518	16	348,368
80-84	87	2,205,767	7	264,083	7	150,173
85-89	56	1,171,110	6	158,277	11	135,224
90-94	29	497,976	1	34,112	10	147,670
95+	15	237,396	0	0	12	170,513
Total	**879**	**21,610,152**	**87**	**3,231,355**	**109**	**2,032,333**
Average Age	**73.2**		**69.9**		**75.8**	
Average Retirement Allowance		**24,585**		**37,142**		**18,645**





SECTION 8 - GLOSSARY OF TERMS

Actuarial Accrued Liability – That portion of the Actuarial Present Value of pension plan benefits which is not provided by future Normal Costs or employee contributions. It is the portion of the Actuarial Present Value attributable to service rendered as of the Valuation Date.

Actuarial Assumptions – Assumptions, based upon past experience or standard tables, used to predict the occurrence of future events affecting the commencement, amount and duration of pension benefits, such as: changes in compensation, mortality, withdrawal, disablement and retirement; rates of investment earnings and asset appreciation or depreciation; and any other relevant items.

Actuarial Cost Method (or Funding Method) – A procedure for allocating the Actuarial Present Value of all past and future pension plan benefits to the current year (Normal Cost) and the past (Actuarial Accrued Liability).

Actuarial Gain or Loss (or Experience Gain or Loss) – A measure of the difference between actual experience and that expected based upon the set of Actuarial Assumptions, during the period between the valuation date and the most recent immediately preceding valuation date.

Actuarial Present Value – The dollar value on the valuation date of all benefits expected to be paid to current members based upon the Actuarial Assumptions and the terms of the Plan.

Amortization Payment – That portion of the pension plan appropriation which represents payments made to pay interest on and the reduction of the Unfunded Accrued Liability.

Annual Statement – The statement submitted by the local retirement board to PERAC each year that describes the asset holdings and Fund balances as of December 31 and the transactions during the calendar year that affected the financial condition of the retirement system.

Annuity Reserve Fund – The fund into which total accumulated Member Contributions, including interest, is transferred at the time a member retires, and from which annuity payments are made.

Annuity Savings Fund – The fund in which Member Contributions plus interest credited are held for active members and for former members who have not withdrawn their contributions and are not yet receiving a benefit (inactive members).

Assets – The total value of the investments held by the Plan trust that are for the payment of promised benefits. Employer appropriations and Member Contributions, as well as investment earnings, are added to the Plan trust. Benefit payments and other disbursements are withdrawn from the Plan trust. For valuation purposes, assets are usually measured at market value.

Cost of Benefits – The estimated payment from the pension system for benefits for the fiscal year.

Expense Fund – The fund into which the appropriation for administrative expenses is paid and from which all such expenses are paid.

SECTION 8 - GLOSSARY OF TERMS

Funded Ratio – The Actuarial Value of Assets expressed as a percentage of the Actuarial Accrued Liability.

Funding Schedule – The schedule based upon the most recently approved actuarial valuation which sets forth the amount which would be appropriated to the pension system in accordance with Section 22D and Section 22F of M.G.L. Chapter 32.

GASB – Governmental Accounting Standards Board.

Normal Cost – Total Normal Cost is that portion of the Actuarial Present Value of pension plan benefits which is expected to accrue in the current fiscal year. The Employee Normal Cost is the amount of the expected Member Contributions for the current fiscal year. The Employer Normal Cost is the difference between the Total Normal Cost and the Employee Normal Cost.

Pension Fund – The fund into which appropriation amounts as determined by PERAC are paid and from which pension benefits are paid.

Pension Reserve Fund – The fund which shall be credited with all amounts set aside by a system for the purpose of establishing a reserve to meet future pension liabilities. These amounts would include excess interest earnings.

Present Value of Future Benefits – The actuarial present value of the cost to finance benefits payable in the future, discounted to reflect the expected effects of the time value of money and the probabilities of payment.

Special Fund for Military Service Credit – The fund which is credited with amounts paid by the retirement board equal to the amount which would have been contributed by a member during a military leave of absence as if the member had remained in active service of the retirement board. In the event of retirement or a non-job related death, such amount is transferred to the Annuity Reserve Fund. In the event of termination prior to retirement or death, such amount shall be transferred to the Pension Fund.

Total Pension Liability – The portion of the Actuarial Present Value attributable to past service in accordance with the Entry Age cost method as stipulated by GASB Statement Number 67 (GASB 67).

Unfunded Actuarial Accrued Liability – The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.

SECTION 9 - VALUATION RESULTS BY GROUP

Group	City of Haverhill	Housing Authority	Police & Fire	School	Waste Water	Water	Whittier Tech	Hale Hospital	Total
Summary of Member Data as of January 1, 2020									
Active Members	139	15	205	527	24	28	51	0	989
Average Age	50.0	48.7	42.7	47.2	45.8	52.1	52.1	0.0	47.0
Average Service	11.7	8.1	14.3	7.8	13.5	22.0	13.7	0.0	10.6
Salary	7,603,102	947,219	15,900,467	17,092,543	1,633,443	1,805,490	2,531,539	0	47,513,803
Average Salary	54,699	63,148	77,563	32,434	68,060	64,482	49,638	0	48,042
Retired Members and Beneficiaries	189	14	166	254	24	15	44	282	988
Annual Pensions	4,460,276	397,309	7,462,845	3,556,665	939,628	459,581	726,657	5,639,525	23,642,485
Average Age	74.9	74.1	72.1	73.6	72.9	69.7	74.3	73.3	73.5
Disabled Members	8	0	52	7	0	5	4	11	87
Annual Pensions	215,765	0	2,369,522	182,537	0	138,391	88,433	236,707	3,231,355
Average Age	71.6	0.0	69.6	70.8	0.0	69.7	63.6	72.1	69.9
Inactive Members	35	1	16	175	3	2	14	15	261
Annuity Savings Fund	655,034	37,306	395,447	1,646,185	115,154	3,969	452,604	553,205	3,858,904
Normal Cost as of January 1, 2020									
1.1 Total Normal Cost	1,102,163	136,963	3,352,608	2,662,183	204,302	214,961	369,631	0	8,042,811
1.2 Employee Normal Cost	677,952	90,837	1,522,376	1,518,775	152,427	159,692	232,643	0	4,354,702
1.3 Administrative Expenses	68,519	8,515	208,422	165,500	12,701	13,364	22,979	0	500,000
1.4 Net Employer Normal Cost = 1.1 - 1.2 + 1.3	492,730	54,641	2,038,654	1,308,908	64,576	68,633	159,967	0	4,188,109
Actuarial Accrued Liability as of January 1, 2020									
2.1 Active Employees	21,065,502	1,623,773	56,211,955	29,943,637	4,912,637	8,125,804	7,293,721	0	129,177,029
2.2 Retired Members and Survivors	43,435,638	4,207,661	74,455,941	36,063,632	9,586,452	4,756,380	7,259,274	54,588,409	234,353,387
2.3 Disabled Members	2,247,124	0	24,397,789	1,995,959	0	1,486,363	1,179,670	2,545,602	33,852,507
2.4 Inactive Members	655,034	37,306	395,447	1,646,185	115,154	3,969	452,604	553,205	3,858,904
2.5 Total = 2.1 + 2.2 + 2.3 + 2.4	67,403,298	5,868,740	155,461,132	69,649,413	14,614,243	14,372,516	16,185,269	57,687,216	401,241,827
Actuarial Value of Plan Assets as of January 1, 2020									
3.1 Actuarial Value of Assets	35,733,260	3,111,260	82,416,340	36,924,018	7,747,611	7,619,462	8,580,477	30,582,366	212,714,794
Unfunded Actuarial Accrued Liability (UAAL) as of January 1, 2020									
4.1 UAL = 2.5 - 3.1	31,670,038	2,757,480	73,044,792	32,725,395	6,866,632	6,753,054	7,604,792	27,104,850	188,527,033
4.2 UAL ERI 2002	2,300,768	53,235	880,663	701,061	199,350	248,388	40,394	0	4,423,859
4.3 UAL ERI 2003	791,042	0	1,094,410	658,175	539,663	198,802	20,716	0	3,302,808
4.4 UAL non-ERI	28,578,228	2,704,245	71,069,719	31,366,159	6,127,619	6,305,864	7,543,682	27,104,850	180,800,366

SECTION 9 - VALUATION RESULTS BY GROUP

Group	City of Haverhill	Housing Authority	Police & Fire	School	Waste Water	Water	Whittier Tech	Hale Hospital	Total
FY2021 Appropriation									
5.1 Employer Normal Cost, July 1	488,605	54,183	2,021,587	1,297,950	64,035	68,058	158,628	0	4,153,046
5.2 Amortization Payment of ERI 2002	230,792	5,340	88,340	70,324	19,997	24,916	4,052	0	443,761
5.3 Amortization Payment of ERI 2003	79,350	0	109,781	66,022	54,134	19,942	2,078	0	331,307
5.4 Amortization Payment of UAL*	2,841,007	245,740	6,256,933	2,302,417	548,086	513,877	642,766	2,431,479	15,782,305
5.5 Net 3(8)(c) Transfers	83,601	7,103	175,789	66,851	16,799	10,691	14,573	105,058	480,465
5.6 Total = 5.1 + 5.2 + 5.3 + 5.4 + 5.5	3,723,355	312,366	8,652,430	3,803,564	703,051	637,484	822,097	2,536,537	21,190,884
FY2022 Appropriation									
6.1 Employer Normal Cost, July 1	497,495	55,169	2,058,367	1,321,565	65,200	69,296	161,514	0	4,228,606
6.2 Amortization Payment of ERI 2002	240,022	5,554	91,873	73,137	20,797	25,913	4,214	0	461,510
6.3 Amortization Payment of ERI 2003	82,524	0	114,172	68,663	56,299	20,740	2,161	0	344,559
6.4 Amortization Payment of UAL**	2,610,581	249,371	6,574,099	2,947,997	565,944	587,494	699,975	2,502,673	16,738,134
6.5 Net 3(8)(c) Transfers	90,480	7,688	190,253	72,352	18,181	11,571	15,772	113,703	520,000
6.6 Total = 6.1 + 6.2 + 6.3 + 6.4 + 6.5	**3,521,102**	**317,782**	**9,028,764**	**4,483,714**	**726,421**	**715,014**	**883,636**	**2,616,376**	**22,292,809**
Increase over prior year	-5.43%	1.73%	4.35%	17.88%	3.32%	12.16%	7.49%	3.15%	5.20%
FY2023 Appropriation									
7.1 Employer Normal Cost, July 1	514,907	57,100	2,130,410	1,367,820	67,482	71,721	167,167	0	4,376,607
7.2 Amortization Payment of ERI 2002	249,624	5,776	95,548	76,062	21,629	26,950	4,383	0	479,972
7.3 Amortization Payment of ERI 2003	85,825	0	118,739	71,410	58,551	21,570	2,247	0	358,342
7.4 Amortization Payment of UAL	2,793,170	266,813	7,033,905	3,154,186	605,527	628,585	748,933	2,677,715	17,908,834
7.5 Net 3(8)(c) Transfers	90,480	7,688	190,253	72,352	18,181	11,571	15,772	113,703	520,000
7.6 Total = 7.1 + 7.2 + 7.3 + 7.4 + 7.5	**3,734,006**	**337,377**	**9,568,855**	**4,741,830**	**771,370**	**760,397**	**938,502**	**2,791,418**	**23,643,755**
Increase over prior year	6.05%	6.17%	5.98%	5.76%	6.19%	6.35%	6.21%	6.69%	6.06%

Notes:

1. FY2022 and FY2023 Appropriation is based on Funding Schedule C-5.

2. 2021 Employer Normal Cost (5.1) is the Employer Normal Cost as of January 1, 2020 (1.4), adjusted for payment timing. 2022 Employer Normal Cost (6.1) is based on 2020 Employer Normal Cost (5.1) increased by 3.5%.

*3. Amortization Payment of UAL (5.4) equals fiscal year 2021 budgeted appropriation (5.6) developed in the January 1, 2018 actuarial valuation less Employer Normal Cost (5.1), amortization payment to ERI (5.2 and 5.3) and Net 3(8)(c) transfers (5.5).

**4. Amortization Payment of UAL (6.4) is the total Amortization Payment of UAL (6.4) allocated to each department in the proportion that the UAL (4.1) less 2021 Amortization Payment of UAL (5.4) bears to the total UAL (4.1) less total Amortization Payment of UAL (6.4).